An EPA Perspective on Reburn Technology for NOx Control

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Summary

In 1980 the U.S. Environmental Protection Agency (EPA) began an in-house program to evaluate reburn for NOx control. Soon after initiating tests to look at natural gas and oil as reburn fuels, we contracted with Energy & Environmental Research Corporation (EER) to perform tests with coal. Following that the Gas Research Institute (GRI) piggybacked on our tests to obtain more data with natural gas. After several years of bench- and pilot-scale research, EPA and GRI agreed to cosponsor a full-scale demonstration of gas reburn. About 1988 a Request for Proposals was issued. At that time EPRI decided to join the partnership. A contract was awarded to Combustion Engineering (CE) who proposed performing the tests on a 108 MW cyclone boiler at the Niles Station of Ohio Edison in Niles, Ohio. Soon after the contract was awarded the U.S. Department of Energy (DOE) joined the partnership. The Ohio Coal Development Office also provided funds. This was the first reburn demo performed in the United States. A NOx reduction of 50% was achieved.

During the project representatives from the Soviet Union met with EPA and requested help controlling NOx from their coal-fired utility boilers. Since they use a lot of wet-bottom boilers, low NOx burners were not a good option, but reburn technology was ideal. We agreed to have CE prepare the conceptual design for a gas reburn system, the All Russian Heat Engineering Institute (VTI) would prepare the engineering drawings, and a 300 MW wet-bottom coal-fired boiler at the Ladyzhin Power Station in Ukraine would install the system. The system was installed and tested in 1992 and a NOx reduction of 52% was achieved. Soon after that it was decided to install a coal-reburn system on an identical boiler at the Ladyzhin Power Station. Due to numerous delays caused by changes in personnel and lack of finances at the Ladyzhin Power Station, this project has only been partially completed.

In the meantime, U.S. EPA was asked for assistance in reducing NOx from industrial boilers in Taiwan. As a result, a coal-reburn system was designed by GE EER and was installed on a 20 MW boiler used at a paper plant owned by the Cheng Loong Corporation. Due to boiler operating problems, the boiler is usually not operated above 12 MW. The system was installed and tested in September 2002 and a NOx reduction of 50% was achieved. Due to the recent interest in mercury control on coal-fired boilers, U.S. EPA and Taiwan EPA have agreed to perform tests on this boiler to determine the effectiveness of increased carbon in the ash, caused by the coal-reburn system, to capture

mercury. Those tests are ongoing. Bench-scale tests performed by GE EER have indicated the potential for up to 80% mercury capture using this approach.

In September 2003 representatives of U.S. EPA and GE EER met with the operators of China's largest power station, the Beilun Power Station in Ningbo, China to discuss the use of reburn technology for controlling NOx emissions. China is very interested in reducing NOx emissions prior to the 2008 Olympics and because they recently joined the World Trade Organization. The Beilun Power Station has five 600 MW boilers of different designs. Reburn could be used in addition to low NOx burners to achieve a NOx reduction of 70 to 80%. The station is working with Zhejiang University and the Zhejiang Energy Group to evaluate their options.

It is clear that reburn technology can be applied to a wide variety of boiler designs burning various fuels to achieve NOx reductions of 50 to 60%. Based on tests run by GE EER and others, by combining reburn with LNB or non-selective catalytic reduction, NOx reductions of as 80% can be achieved. EPA views reburn technology as one of several ways to achieve NOx reduction. It is cost effective, can be performed with a variety of fuels in the reburn zone, and has been demonstrated on a wide range of boilers throughout the world. The decision of which technology to use depends on the level of NOx reduction required and should be made by the boiler owner.